CONSIDERATIONS FOR IMPLEMENTING A TRUNKED PUBLIC SAFETY RADIO SYSTEM

EXECUTIVE DEVELOPMENT

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An applied research project submitted to the National Fire Academy
As part of the Executive Fire Officer Program

February 1999

ABSTRACT

This research project analyzed the various problems that affect the implementation of a public safety trunked radio system. The problem was that the city of Charlottesville had no plan for the implementation of an 800 trunked radio system for public safety agencies. The purpose of this project was to develop a comprehensive list of recommendations that the city of Charlottesville could use when implementing a new 800 trunked public safety radio system.

This research employed both historical and action research in that the information gathered through historical research was applied to the actual specification and request for proposals for an 800 trunked public radio system for the Charlottesville region. The compilation of 800 trunked radio system information was developed from historical research through the use of a survey device titled 800 Trunked Radio Systems.

The principal procedure employed was review of information received from like-size emergency service agencies, manufacturers and consultants.

The major findings of this research were that there are many factors which create problems when implementing an 800 trunked radio system. The research findings were incorporated into a checklist appropriate for addressing the various stages of the 800 radio system implementation.

The recommendations resulting from this research included (a) incorporating the use of the checklist into the implementation plan and (b) adding these elements into the RFP for a new system to help in the successful procurement of a new 800 trunked public safety radio system.

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INTRODUCTION

The Charlottesville Fire Department (CFD) recognized the need for a new public safety radio system many years ago. To a reasonable extent, the CFD makes a conscious effort to stay abreast of new technology in the area of radio communications due to its vital role in the department's emergency service effectiveness. In spite of such efforts, it is not sufficient to fully understand the complex nature of 800 trunked radio systems. A major problem is that the city of Charlottesville does not have a plan for implementing a new 800 trunked public safety radio system.

The purpose of this research paper was to develop a comprehensive list of recommendations that the city of Charlottesville can use when implementing a new 800 trunked public safety radio system. Historical and action research methods were employed to answer the following questions:

1. What problems have other like-sized public safety agencies experienced when implementing 800 trunked radio systems?
2. What do other public safety agencies recommend to avoid the problems they experienced?
3. What do manufacturers of 800 trunked radio systems recommend to avoid problems?
4. What, if any of these recommendations can be adapted to our department's specific situation?

BACKGROUND AND SIGNIFICANCE

Current demographic changes in the Charlottesville region, continue the trend of the last decade in at least one way important to local emergency service agencies. Population growth continues to increase at a steady rate resulting in an increased incident load and increased demand in the area of radio communications. Additionally, the public radio system of this region is outdated, obsolete, and is scheduled for replacement in the year 2000 (G. O'Connell, personal communication, September 9, 1997).

The Charlottesville Fire Department has stated publicly that the need for a new radio system is imperative. System failures have repeatedly highlighted this critical need (J. Taliaferro, personal communication, August 4, 1996). After many meetings, it was agreed to replace the existing radio system with a new "state of the art" 800 trunked radio system. Presently, all public safety agencies are using conventional radio technology on VHF or UHF frequencies. There is no common interface thus no way of communicating between emergency agencies on the present system.

Moving forward requires the installation of a new multi-agency 800 trunked public safety radio system that will include agencies for the entire Charlottesville-Albemarle region. The success of this new radio system will have a lasting affect for all public safety agencies. This type of trunked radio system presents significant complexities over the more traditional conventional two way radio systems (J. Leikhim, personal communication, August 21, 1998). Developing an effective 800 trunked radio system requires a systematic approach that encompasses all stages of implementation from the

very beginning stages of needs assessment through the final stages of system acceptance (F. Griffin, personal communication, September 10, 1998).

As part of this 800 trunked radio system project, the Emergency Communications Center Board established a joint committee to coordinate all phases of the system (ECC Board Directive, personal communication, July 7, 1997). This group included law enforcement, emergency medical services (EMS), and firefighting personnel from the city of Charlottesville, Albemarle County, and the University of Virginia. This subcommittee would be known as the Emergency Services Providers Advisory Radio Sub Committee (Board of Supervisors, personal communication, August 12, 1997).

This research project also has a larger significance, as it will provide a comprehensive reference for other emergency agencies that are migrating to new 800 trunked radio systems. This is, by in large, the accepted radio system type of the present and near future for public safety agencies (J. Dyche, personal communication, August 27, 1998).

LITERATURE REVIEW

Experiences with 800 Trunked Radio Systems

With few exceptions, the installation of traditional radio systems in the United States historically did not require a high degree of technical expertise. During the last 10 years, however, the experience of emergency service agencies has proved that this new technology requires a new look at how we implement it.

In Honolulu, Hawaii, the Fire Department started using the system but went back to the old conventional system after only 8 days. The Honolulu Police Department

stated, “Problems with new digital equipment put officers in danger” (Moore, 1998). The result is that Officers had lost confidence in the reliability of the system.

In 1993, the city of Hampton, Virginia refused to accept the system due to “dead spots” in remote areas and in certain buildings. The problem was nearly 5 years old and still reported not resolved. Ericsson strongly disagrees with these claims (Willisma, 1998).

In Kansas City, Missouri the 800 radio system was not performing. After two years of accusations, Kansas City accepted the blame as they tried to reduce the specifications in an attempt to save money. The changes made to the specification requirements were made against earlier recommendations by a hired consultant. Kansas City will have to spend another $8.5 million to enhance its coverage to an acceptable level. Council-Woman Aggie Stackhaus questioned, “How did someone have such flawed decision making that they would try to save $8 million and put peoples lives at risk?” (Tusa, 1998).

In Eden Prairie (CO), their local agencies identify their success with the use of APCO (Associated Public Communications Officers) Standards to define a standard, features, and functions. Unique identification codes were one result of using these standards as they assign unique identification to each radio user. It can easily identify the radio user and even disable the radio if necessary (Giorgi, 1992).

Pinellas County Florida, defined that 800 trunked radio systems require the definition of special needs. Their needs included mutual aid, emergency alarm features, telephone interconnect functionality, private call option, and encryption (Meeker, 1993).

Failing to identify these needs would result in not having the features or creating some operational deficiency from inadequately addressing them.

In Seattle, Washington, they report that while the system works, improvements are needed for satisfactory coverage. Also converting from “smart zone” transmissions to simulcasting will dramatically improve system effectiveness by improving signal coverage. Non simulcasting limits their current volume of radio traffic (Roberts, 1998).

In Atlanta (GA), public safety agencies had to develop a complex radio system that involved a great number of subsystems (AVL, CAD, MDT, etc.) as well as include an unusual number of local and outside agencies to prepare for the Atlanta Olympic Games. This complexity highlighted the benefit of a system integrator. Their role is to oversee interoperability and functionality of the entire system. The system was successfully implemented under budget and ahead of schedule (J. Dyche, personal communication, August 27, 1998).

In Port Orange (FL), other issues surfaced that caused concern. Some of these problems were discovered to be an across-the-board scenario to all vendors. These problems included:

- inability to transmit inside buildings
- reduced performance relative to smoke, rain, and fog
- water shorting out portable radios

An even larger problem exists due to the inability of an agency served by one 800 radio vendor to communicate with an agency served by another radio vendor due to the high degree of proprietary equipment. Meister (1998) also notes that it appears that due to

the limited number of vendors that they sometimes do not listen to their customers and make responsive corrections to problem areas.

One of the biggest problems occurs from little or no training. 800 trunked radio systems function different as each radio user must be queued or acknowledged by the system in order to talk (S. Skibress, personal communication, August 26, 1998). This function requires each radio user to wait approximately a half second to communicate their full message. Failure to wait for this "queue" often results in the first portion of the message being "dropped off" (Meister, 1997).

In Sarasota (FL), they point out that teamwork between all agencies is key to successful movement toward an 800 radio system (Ley, 1998).

Consultant Observations and Recommendations

Implementing a new 800 trunked radio system should be considered a very complex process. In most cases, this project will exceed the expertise and available time of current operations personnel. System mapping may very likely require a computer expert to coordinate the overall system function. It is most important to realize that the systems become more complicated as interoperability between the 800 radio system and other components such as automatic vehicle locators (AVL's), computer aided dispatch systems (CAD), mobile data terminals (MDT's), and smart traffic control systems to name a few (Griffin, 1998). The oversight of interoperability between multiple systems presents the question of whether there should be use of a system integrator. A helpful list of questions for analysis is listed in Appendix G (Parker, 1998).

Consultants take on a larger role in the new radio technology. There are specific areas where consultants may be needed more. Listed in Appendix F are general areas where consultants are recommended (Griffin, 1998).

Since the system is more complex, it also requires a more in depth look at acquiring an 800 trunked radio system. A recommended System Acquisition Process flow is included as Appendix I (Booty, 1998).

Oversight of a public safety trunked radio system becomes imperative to insure ongoing reliability of the system on a daily basis. A system manager is recommended. The systems manager role is defined in Appendix H (Griffin, 1998). Additional role responsibilities are highlighted and added into Appendix H (Pallans, 1993).

PROCEDURES

Definition of Terms

AVL. An AVL is an abbreviation which stands for Automatic Vehicle Locator and is a device that works with satellite or other instrumentation that identifies the location of a vehicle and positions it on a visual map display. In the emergency service field, the system is designed to track vehicles for the purpose of assigning the closest unit for emergency response.

APCO. An abbreviation for Associated Public Communications Officers.

CAD. An abbreviation for Computer Aided Dispatch.

CFD. An abbreviation for the Charlottesville Fire Department.

ECC. An abbreviation for Emergency Communications Center and is the organization that oversees the 911 dispatch operations in the Charlottesville region.

FCC. An abbreviation for the Federal Communications Commission.

NSPAC. An Abbreviation for National Public Safety Planning Advisory Committee.

Trunked Radio System. Is a radio system that functions much like a trunked telephone line. The principal involves the sharing of multiple frequencies by various units and agencies simultaneously. A computer assigns units to available radio frequencies to enable many more users to effectively use the radio system. Users are assigned to "talk groups" which are usually based on their functions. While they may be assigned to various radio frequencies during a radio conversation, the computer coordination allows persons on the same talk group to talk to each other without knowing of the constant radio frequency coordination occurring behind the scenes.

Smart Zone. Is a proprietary distinction of a function on a Motorola radio system. Basically a "smart zone" system uses the radio system based on the location of the unit and accesses only the transmitter closest to the units location.

Research Methodology

The desired outcome of this research was to create a list of recommendations for use in the development and implementation of a new 800 trunked public radio system. The research was historical research in that a literature review was conducted to understand the problems associated with previously installed radio systems and the methods to which these problems were overcome. The data gathered were based on surveys of actual experiences of other emergency service agencies, information from consultants in this field of expertise, and from manufacturers of this type of radio systems. This research methodology used the online resources of the Learning Resource Center, the World Wide Web, personal interviews, personal correspondence,

discussion over Internet message forums, and a survey device called the Applied Research Survey for 800 Trunked Radio Systems and is contained within Appendix A.

The research was action research in that the information gathered through historical research was applied to the actual specification and request for proposals for an 800 trunked public radio system for the Charlottesville region. The compilation of 800 trunked radio system information was developed from historical research through the use of a survey device titled 800 Trunked Radio Systems. The results of that survey are broken down into several categories and are embodied in Appendices A through D.

- Appendix A – Survey Device with Questions.
- Appendix B – General Survey Results.
- Appendix C – Survey Summary of Problems Encountered.
- Appendix D – Survey Summary of Recommendations from Agencies.

Assumptions and Limitations

Although 800 trunked radio systems are becoming more widespread, there is still not a large body of published information available from which research may be conducted. The number of actual 800 trunked public radio systems of like-sized localities with similar operations was limited. For that reason, the survey was broadened to larger cities to accumulate data that would still be relevant to this research.

An even bigger hindering factor was that information was not freely given for fear of litigation (J. Wilkins, personal communications, September 15, 1997). Many agencies having radio operating system problems or in negotiations with manufacturers are reluctant to discuss any “sticky” matters for fear of civil litigation.

The newness of the technology and rapid changes presents a unique factor as 800 trunked radio systems of today are designed differently than conventional radio systems of 10 years ago. This in some ways makes comparisons difficult and can be summed up as comparing oranges to apples.

Lastly, manufacturers were not very cooperative in providing guidelines for purchasing an 800 trunked radio system. Only one vendor sent guidelines to help provide a systematic process. This is due to the extreme competitive nature between vendors for these types of radio system sales. This coupled with the limited number of vendors and their extreme proprietary nature of the radio equipment (D. Dip, personal communication, September 15, 1998).

RESULTS

A sample checklist is shown in Appendix E.

Answers to Research Questions

Research Question 1. An overwhelming number of departments experienced problems, see Appendix C for a summary of the problems. Some of the more recurring problems were:

- inadequate expertise to oversee this complex project from beginning to end
- improperly specifying the systems performance requirements
- trying to design the system rather than performance
- did not address mutual aid needs
- did not perform adequate needs assessment
- did not involve the right parties
- underestimated financial impact

- did not anticipate community opposition to towers
- interoperability problems with other systems

Research Question 2. A full summary of recommendations to avoid the same problems that other departments experienced is listed in Appendix D. The more common methods that departments recommended were:

- hire a qualified consultant with proven experience in this field
- consider using a system integrator if multiple systems will be require interoperability
- conduct a thorough needs assessment and involve all parties
- be certain to identify mutual aid needs in system design
- define strict and precise performance requirements
- keep the public informed and involved
- visit or contact at least three other localities that have installed a similar radio system
- install new system parallel to old system and keep old system operational for 6 months after acceptance of new system
- consider regional/statewide involvement to spread financial burden
- plan early to set aside funds

Research Question 3. One manufacturer recommends some very important points. First, follow a systematic approach from beginning to end, see Appendix I. Determine and define your system performance requirements especially in the areas of radio coverage and in-building performance. Define what coverage standard will be used. Define the grade of service (type of system) to insure comparing “apples” to

“apples”. Some vendors will offer an inferior system and the defined grade of service becomes very important. Plan ahead by getting tower site approval where feasible. A system cannot move ahead without tower sites being approved. Define a specific criteria for evaluating radio system proposals to insure a fair, legal and thorough process. The manufacturer also desires to have one point person for contact. This eases the coordination burden and makes the process more efficient. Keep the political leaders involved and updated on the latest progress (D. Dip, personal communication, September 15, 1998).

Research Question 4. The checklist (see Appendix E) includes guidelines for the various stages of developing an 800 trunked radio system. These stages include planning, procurement, infrastructure/equipment considerations, operations, systems acceptance, and training.

DISCUSSION

The checklist which represents the results of this research, reflects the recommendations for implementing an 800 trunked public radio system by similar emergency service agencies, manufacturers and consultants.

The checklist (Appendix E) should be of considerable value to emergency service agencies looking into the purchase of an 800 trunked radio system. The checklist becomes more valuable as there is limited information available on this technology. The checklist is designed to learn from the mistakes of others in order to avoid the same mistakes. In addition, the lessons learned will help effect better radio systems and save considerable money to those jurisdictions that acquire these radio systems.

RECOMMENDATIONS

Regional procedures for implementing an 800 trunked radio system for public safety use should use the checklist to insure that potential problem areas are addressed. Local governments that are partners on this radio system should integrate the use of the checklist items into their procurement procedures. Training should be provided to all of the localities about these guidelines and the need for their existence and use.

Periodic review and revision of this checklist should be undertaken to keep the checklist up to date. New information based on local experiences along with the driving technology may drive alterations to the form. Additionally, the form should reflect future changes to APCO 16 and APCO 25 standards as well as operational changes to the regional public safety organizations.

Finally, the factors listed in Appendix D should become the basis of an evaluation checklist used for implementing 800 trunked radio systems. CFD and regional public safety organizations would benefit from that planning process both operationally and fiscally. Community residents would benefit from a more effective radio system and ultimately a better delivery of emergency services.

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APPENDIX A
Survey Device – 800 Trunked Radio Systems

National Fire Academy - Executive Fire Officer Program

Applied Research Survey
800 Trunked Radio Systems

This survey is being done for two reasons. First, our City is in the process of developing an RFP for a new regional 800 trunked radio system. Second, I am writing an applied research paper for the National Fire Academy's Executive Fire Officer Program. Your prompt response to this information request will be greatly appreciated. The paper will then be available for other agencies to review and hopefully assist others. Thanks again for your assistance.

1. What is your department/agency name?

2. What is your name, title and email address?

3. What is your address/phone number??

4. Who is the manufacturer of your 800 radio system (digital, analog, or both)?

5. When was your system installed?

6. What was the cost of your 800 trunked radio system (including infrastructure, mobiles, portables)?

7. What was the original quote for the 800 radio system?

APPENDIX A
Survey Device – 800 Trunked Radio Systems

8. If the radio system exceeded original quote, what caused the overrun?

9. Did you use a consultant to help develop your RFP? If yes, how much did the consultant do for your agency?

10. Did you use a consultant to help oversee installation?

11. What is your locality's population? What is the square miles of your service area? Is your radio system a public safety system, public service system or both?

12. Can you list the agencies that use your system (i.e. fire, police, ems, public service)

13. What is the estimated number of field units that operate on your system?

14. How do you accomplish fire/ems station alerting?

APPENDIX A
Survey Device – 800 Trunked Radio Systems

15. Did you perform an acceptance test? _____ **If so, is it possible to get a copy of the acceptance test criteria and the results?**

16. What problems did you experience while implementing your 800 system? (attach separate document if available in another report)

17. Please specify if the problems were infrastructure related, radio equipment related, or a training related problem.

18. How did you overcome the problems that you encountered and what estimated cost for problem resolution?

APPENDIX A
Survey Device – 800 Trunked Radio Systems

19. Did the 800 trunked radio system meet all of your operational expectations? _____
    If no, what expectations were not met and why?

20. How much impact did this new radio system have on training personnel?

21. What new problems did the 800 radio system create for your department/locality?

22. What recommendations would you make to other agencies regarding the procurement, installation and implementation of an 800 radio system?

Please send your response to this survey to:
Charles Werner, Battalion Chief
Charlottesville VA Fire Department
203 Ridge Street
Charlottesville, VA 22902

APPENDIX B
Survey Summary – General Overview

MANUFACTURER

Motorola - 24	Ericsson - 9	E. F. Johnson - 3	Other - 1

INSTALLATION DATE

Prior 1995 - 23	1995 - 5	1996 - 3	1997 - 4	1998 - 2

SYSTEM COST - ACTUAL

1 to 5M - 21	6 to 10M - 7	11+M - 3	Unknown - 6

DID SYSTEM EXCEED BID?

Yes - 6	No - 25	Unknown - 6

USE A CONSULTANT TO HELP WITH RFP?

Yes - 22	No - 15	Unknown - 0

USE A CONSULTANT TO OVERSEE IMPLEMENTATION?

Yes - 13	No - 24	Unknown - 0

POPULATION

0 TO 49,000 - 4	50,000 TO 99,000 - 13	100,000+ - 20

SQUARE MILES

1 TO 15 - 7	16 TO 50 - 13	51+ - 17

OPERATING FIELD UNITS ON RADIO SYSTEM

0 TO 99 - 1	100 TO 999 - 23	1000+ - 13

PERFORM ACCEPTANCE TEST

Yes - 34	No - 3

DID YOU EXPERIENCE PROBLEMS? (*Problems are listed in Appendix C*)

Yes - 26	No - 11

BREAKDOWN OF PROBLEM AREA

Infrastructure - 17	Radios - 8	Training - 3	Political - 3

OVERCOME PROBLEMS?

Yes - 22	No - 4

DID 800 SYSTEM MEET EXPECTATIONS?

Yes - 28	No - 9

APPENDIX B
Survey Summary – General Overview

WAS THERE A TRAINING IMPACT?

Yes - 20	No - 17

DID SYSTEM CREATE NEW PROBLEMS?

Yes - 20	No - 17

CAN YOU OFFER RECOMMENDATIONS? (*Listed in Appendix D)*

Yes - 33	No - 4

APPENDIX C
Survey Summary of Problems Encountered

Tower Sites

- community opposition
- unexpected site development costs
- unexpected construction delays
- unexpected added construction costs

Coverage

- inadequate towers to meet performance specifications
- poor building penetration
- inadequate propagation studies
- failed to consider terrain

Operations

- too many busy signals
- unacceptable audio quality
- problems with radio programming
- problems with encryption equipment
- ineffective communications in high rise buildings, large institutions or aboard ships
- radio interference due to simulcast overlap problems
- intermodulation problems due to improper radio frequency assignments
- “smart” terminals unreliable to address coverage problem, too slow to respond
- site interference
- when system failed, no backup for mobile/portable operation
- couldn’t communicate with mutual aid companies
- too many talk groups to coordinate
- radio procedures too complex
- lack of interoperability with other jurisdictions
- some initial dispatch confusion due to more talk groups
- problem keeping people on proper channel/talk group
- monitoring all talk groups by dispatch practically impossible
- cannot page on 800
- lack of “talk around” capability in fringe areas
- new portable batteries did not hold charge
- radios were not easily programmed in field as promised
- upgraded infrastructure created complications with old system
- personnel rejected audio quality
- personnel failed to wait for queue before transmitting, cutting off voice
- personnel rejected change
- some radio equipment too complicated for end users

APPENDIX D
Survey Summary of Recommendations from Other Agencies

Planning

- hire a consultant to conduct a needs assessment and provide recommendations to meet identified needs
- include all present/future users of system in needs assessment phase
- think regionally, try to use existing systems if possible to reduce infrastructure costs and interoperability with neighboring jurisdictions
- request RFP's from other like-size localities for reference
- keep public informed/involved throughout the process
- determine how to deal with mutual aid issues
- hold regular planning meetings to update staffs of all involved
- assign a project manager at the very beginning
- do your homework, where possible visit or at least contact other localities
- determine and secure financing

    1. provide upfront/realistic budget estimates
    2. plan early to give time to set funds aside
    3. identify life cycle costing for infrastructure/radio equipment
    4. outline a plan for ongoing maintenance and operational costs

- decide on approach (in-house staff, consultant, and/or integrator)
- develop a plan that takes you from planning through acceptance
- identify method of alerting companies and/or stations
- conduct multiple propagation studies for consultant review
- don't oversell capabilities of the system
- identify system user priorities in early stages
- determine what frequencies are available and apply early

Procurement

- consider consultant assistance in developing RFP
- define system performance requirements
- don't try to design the system
- don't allow manufacturers to lobby once RFP has been issued
- provide tower/antenna sites already available but let the vendor recommend sites to meet performance specifications
- include penalties for delays, hold vendor to schedule
- define backup plans in RFP
- assign a radio system manager
- maintain an ongoing relationship with your attorney, regular meetings
- have all procurement documents reviewed by consultant, purchasing agent and attorney
- require at least 3 references of similar radio systems that have been operational for at least one year

APPENDIX D
Survey Summary of Recommendations from Other Agencies

Procurement (continued)

- review APCO 16 and 25 standards for possible inclusion into RFP
- develop a comprehensive acceptance test
- visit operational sites, talk with users (exclude the vendor)
- get all commitments or changes in writing
- determine how long vendor will support equipment
- include a migration plan if future expansion is anticipated
- ask the vendor to address migration plan for future changes to radio spectrum
- define a "required" assigned installation team that is 800 trunk qualified
- identify potential buildings where known penetration problems exist
- consider adopting a new building ordnance to deal with internal antennas to insure radio operation in emergencies
- require new system to be operational under acceptable circumstances for at least 6 months before shutting off old radio system
- install new system parallel to old system

Equipment Considerations

- define specs for portable radios
- specify UPS for all radio/computer equipment
- use lower quality portable radios for non public safety applications
- keep features to a minimum for field units
- define lightning protection for all radio equipment including tower/antenna sites
- consider fiber optic as an alternative to microwave link
- look at and touch all equipment in bid
- consider simulcast rather than "smart" terminals
- require talk around capabilities

Operations

- identify backup procedures in case of system failure
- limit number of talk groups
- keep radio procedures simple
- preplan with neighboring jurisdictions
- simulate large incidents and practice radio usage
- define how specific talk groups are to be used
- define sufficient talk groups for operational needs
- emphasize need for training

Training – It has been noted that training is one of the most important components for a successful radio system

- develop a comprehensive training program for all users
- provide 6 months of training and practice before going live

APPENDIX D
Survey Summary of Recommendations from Other Agencies

Training (continued)

- must deal with apprehension/resistance from older/non technical employees
- training must overcome mindset of conventional radio systems
- training must identify system features and characteristics
- training must demonstrate proper use of radio equipment
- create training references (faq's)
- conduct simulation training for various scenarios
- schedule regular training at least every 6 months

APPENDIX E
Checklist

Planning

- Do we need a consultant?
- Have we completed a “needs assessment”?
- Recommendations to meet identified needs?
- Have we included all present/future users of system in needs assessment phase?
- Have we considered a regional approach to limit costs?
- Have we received RFP’s from other like-size localities for reference?
- Do we have a plan to keep public informed/involved throughout the process?
- Have we listed and considered mutual aid issues?
- Schedule regular planning meetings to update staffs of all involved.
- Who will be the project manager?
- Visited or contacted other localities with 800 radio systems?
- What are projected costs and what funding is available?
- What is the life cycle cost estimates for this project?
- What is the plan for ongoing maintenance and costs associated?
- In-house staff, consultant, and/or integrator?
- Plan developed?
- Determine method of alerting companies and/or stations.
- Obtain multiple propagation studies for consultant review.
- Identify system user priorities in early stages.
- What frequencies are available, how many do we need and how do we apply?

Procurement

- Hire a consultant assistance in developing RFP?
- What is our system performance requirements?
    1. mobile coverage
    2. portable coverage
    3. building penetration/performance
    4. audio quality
- Determine if any additional tower sites need approval.
- Are penalties built into schedule?
- What are the backup plans in RFP?
- Who will be assigned as the radio system manager?
- Schedule regular meetings with staff, public, attorney, purchasing.
- All procurement documents reviewed by consultant, purchasing agent and attorney
- Determine what if any APCO 16 and 25 standards should be included in RFP.

APPENDIX E
Checklist

- Develop comprehensive acceptance test:
    1. portable performance
    2. mobile performance
    3. building performance
    4. audio quality

- How long vendor will support equipment?
- Will we need a migration plan?
- Require credentials for installation team.
- What potential buildings do we know where penetration problems exist?

Equipment Considerations

- Define specs for portable radios:
    1. intrinsically safe
    2. user identification capable
    3. emergency notification feature
    4. audio quality
    5. ease of portable operation while wearing gloves
    6. portable able to withstand wind and forced rain
    7. portable

- Have we seen all equipment in bid prior to awarding RFP?

Operations

- Established procedure for backup?
- Defined number of talk groups?
- Have we addressed all mutual aid issues with neighboring jurisdictions?

Training – It has been noted that training is one of the most important components for a successful radio system

- Develop a comprehensive training program for all users?
- Establish training schedule to provide 6 months of training and practice before going live/
- Schedule regular training at least every 6 months.

APPENDIX F
Considerations of when to use a consultant

- Needs Analysis
- Funding Alternatives
- Cost Allocation
- Procurement
- Applying for Radio Frequencies
- Negotiations with Vendors
- Evaluation of RFP
- Implementation Oversight or Management
- Claim/Change Order Resolution
- Acceptance Testing/Warranty Monitoring

APPENDIX G
Factors for Deciding on a System Integrator

- Project costs?
- How complex is the System?
- Does your organization have sufficient personnel with time and expertise?
- Do you wish to have a “turn key” system?
- How many localities will be involved in the project?
- Are there any mutual aid or communications needs with neighboring jurisdictions?
- Will the system involve users beyond this region?
- How many agencies will be using the system?
- How many radio units will be on the system?

APPENDIX H
The Responsibilities of a System/Operations Manager

- Must be on site and managing system
- Plans for and implements radio programming and radio user priorities
- Oversees the development of effective talk groups and fleet mapping
- Coordinates/monitors equipment installation
- Continuous data base management
- Assigns system user identifications
- Develops disaster or “storm” plans
- Institutes and oversees preventive maintenance program
- Develops and oversees a comprehensive training program
- Manages any antenna site rentals or coordination
- Landlord relations
- FCC/FAA Liaison – License management
- Generates and evaluates system reports
- May coordinate joint user group
- Bill jurisdictions as appropriate by established formulas

APPENDIX I
System Acquisition Process

Identify the Requirement

Study Group

- Group Leader
- Group Members (user group, finance, purchasing)

Outside Consultant?

- Tasks?
  - Needs Analysis
  - Requirements Study
  - RFP Generation
  - Proposal Evaluation
  - Project Management

- Need?
  - Experience/skills not available in-house?
  - Political

- Position?
  - Contractor
  - Study Group Member

Document Existing System

- User Groups
- Units
- Channels
- Communications Center
- Interfaces to Other Systems
- Sites
- Coverage
- Mutual Aid/Interoperability
- Special Functionality
- Deficiencies

Map Current Communications Procedures

- Normal Operations
  - Dispatch
  - Incident
  - Ancillary
- Major Incident
  - Non-Normal Communication Flow
  - Increased System Stress

APPENDIX I
System Acquisition Process

- Mutual Aid/interoperability

Define New System Requirements

- User Groups
- Coverage
- Grade of Service
- Reliability
- Communications Center
- Mutual Aid/Interoperability
- Interfaces to Other Systems
- Special Functionality

Document Resources

- Channels
- RF Sites
- Communications Center
- Interconnecting Network
- Funding

Research Alternative Solutions

Review System Requirements

- Individual User Group Reviews to Assure all included
- Compile a Checklist of Requirements to use in Evaluating Alternative System Solutions

Study Technology Alternatives

- Public – Private
- Conventional – Trunked
- Analog – Digital
- Simulcast – Multicast

Study Existing Systems

- Systems of Similar Size and Operations
- Examples of Different Technologies
- Document Requirements Satisfied

Select New Technology

- Grade Technology Alternatives Against New System Requirements
- Select the Technology that Best Satisfies the Requirements

APPENDIX I
System Acquisition Process

Define New System

Define System

- Document Finalized System Scope
  - Operational Requirements
  - RF Subsystem
  - Communications Center Subsystem
  - Interconnection Subsystem
  - Alarm and Control Subsystem
  - Paging Subsystem
  - Data Communications Subsystem
  - Fire Alerting Subsystem
  - Interfaces to Other Systems

Impact Statement

- Each User Group Reviews New System for Impact on Operations
  - Improved Coverage
  - Improved Access
  - Improved Interoperability
  - New Functionality
  - Improved Efficiency
  - Improved Safety
  - Reduced Costs

Integrator?

- Tasks?
  - Total System Supplier
  - Project Management
  - Consultation
- Need?
  - Multiple Diverse Technologies Involved
  - Experience not Available in-house
- Position?
  - Prime Contractor
- Trade Off?
  - Costs

Estimate System Costs – Budgetary Estimate

- All Operational Requirements
- All Required Subsystems
- Site Acquisition/Development

APPENDIX I
System Acquisition Process

Estimate System Costs – Budgetary Estimate (continued)

- Civil Construction
- Project Management
- Implementation Timeline
- Acceptance Testing
- Training
- Cutover
- Warranty
- System Management
- Maintenance

Define Plan of Action

- Integrator or Consultant Involvement?
- RFP – RFQ – Non Competitive Procurement?
- Project Implementation Timeline?
- Funding Method?

Report to Management

- System Need
- System Definition
- System Impact
- System Plan of Action
- System Funding

Project Approval

System Funding and Specification

System Project Leader and Team

- Same Member Guidelines as Study Group
- Mid-Upper Level Management
- Group Members (users, finance, purchasing, integrator, consultant)

User Requirements – System Design

- Detailed user Needs Analysis
- Document System Functionality Required to Meet Needs
- Finalize Subsystems Required to Provide Functionality

APPENDIX I
System Acquisition Process

System Specification

- Write System/Subsystem Specifications
  - Specification
  - Implementation
  - Acceptance Testing
  - Training
  - Cutover

- Write Support Requirements
  - Warranty
  - Maintenance
  - System Management

Select System Supplier

System Functionality Review

- Final Review of Specification to Assure User Required Functionality is included (all user groups represented)

Assess System Suppliers

- RFP – RFQ – Non-Competitive Procurement?
- Evaluation Process

Select System Supplier

- Notify Selected System Supplier
- Define Final Project Team
- Set Procedures for Contract Negotiation

System Negotiation Process

- Establish Common Goals for the Negotiations
  - Achieve Best Possible System at Best Possible Price
  - Achieve a Complete Understanding of all elements of the System and Project while Matching the Expectations of all parties.

Issue Resolution

- Establish Procedures for Issue Resolution and Documentation, Including:
  - Issue Discussion
  - Issue Resolution
  - Resolution Documentation
  - Resolution Approval
  - Publication

APPENDIX I
System Acquisition Process

Implement System

Implementation Process

- Finalize System Design
- Site Acquisition
- Construction
- System Performance Verification
- Training
- Cutover

Finalize System Design

Site Acquisition

- Zoning Approval
- Site Lease Agreements
- Permits

Verify System Performance

- Acceptance Tests
  - Functionality
  - Coverage
  - Fall Back Modes
- Reliability Tests
  - Both Old and New Systems On-line
  - Test Period Measuring Systems Availability or “Uptime”

Training

- Dispatcher Training
- System Manager Training
- Field Unit User Training
- Maintenance Training
- Coordination with Cutover

System Cutover

- Minimize Operational Disruption
- Subsystem Cutover Sequence
- Concurrent Operation
- Planned Fall-Back